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To discover how costs affect quality, 16 different methods of computing educational costs are developed and correlated with a cluster of "quality related" factors (QRC). Data for the correlation were obtained from 1,055 city school districts in 48 states. The QRC is composed of staffing adequacy variables, measures of teacher quality, and provisions for instructional materials. To study the effect of using various weighting factors in cost-quality studies, the 16 expenditure yardsticks were subjected to weighting which compensated for secondary ADA figures. The best predictor of educational quality was total expenditures less capital outlay and transportation; weighting secondary school pupils did not improve the predictability of the measure. The study questions the validity of the cost measures in cost-quality studies where weighting for secondary school pupils was used. (HW)

Testing the Cost Yardstick in Cost-Quality Studies

James N. Finch*

The long history of cost-quality studies in education goes back to the early decades of this century. Basic to these studies and all research dealing with cost factors is the necessity of adequately defining cost. In other words, the measure of financial input used must reflect as closely as possible the true costs of educational programs. Some cost-quality studies used an overall measure of school expenditure per pupil. Others used a measure which excluded debt service and capital outlay. Many of them relied on a measure of expenditure which weights high school pupil units. All these cost yardsticks were derived from the literature of state aid, where the intent is not primarily to provide an expenditure criterion, but to supply a means for equalizing educational costs.[1] The latter purpose is incompatible with the former.

However, as research techniques become more sophisticated and as competition for the educational dollar increases, it is important to develop as exact a yardstick of program cost as possible. The present study utilized expenditure data from 1,055 city (3,000 to over 1,000,000 pupils) school districts in 48 states. Sixteen different methods of computing educational cost were developed from this data. The expenditure measures were correlated with a cluster of "quality related" factors developed from the same data. These quality related factors consisted of staffing adequacy measures and other quantitative characteristics of schools that previous research has shown to be quality related.[2] As this Quality Related Composite (QRC) is compared to the sixteen expenditure measures in a multiple regression program, it is possible to compare the relative strength of the various financial yardsticks as predictors of QRC.

The various methods of computing expenditure depend upon various types of "non-educational" expenditure which are subtracted from the total budget. The subtractive expenditure items used in this study were selected because they are major expenditure items that do not directly relate to the instructional process, are easily obtained through existing accounting procedures and have been used in various combinations as subtractives in other finance studies. The sixteen measures resulting from various combinations of subtrahend are listed in Table 1.

In computing *per pupil* expenditure in each case, average daily attendance for the data year (1962-63) was used. In this procedure, half day kindergarten attendance figures were converted to full day equivalents and added to the elementary and secondary ADA, thereby deriving a school district average daily attendance. The division of this district ADA figure into the sixteen expenditure level measures per district resulted in sixteen expenditure level computations per pupil in average daily attendance for each district.

Effects of Weighting Examined

To study the effect of using various weighting factors in cost-quality studies, the sixteen expenditure yardsticks were further examined when subjected to weighting which compensated for secondary ADA figures by 15%, 20%, 25% and 30%. The 25% weighting is now used in the Institute of Administrative Research finance studies and the 30% weighting is used in the *School Management* comparative school finance studies.[3] The former is and the latter was the high school pupil weighting factor employed in the New York State equalization formula, and weightings of similar magnitude are

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[1]For a review of the cost-quality studies, see William S. Vincent and John W. Polley, *Does Money Make a Difference?* New York Associated Public School Systems, 1958.

[2]Donald H. Ross, ed., *Administration for Adaptability*, Metropolitan School Study Council, Teachers College, Columbia University, 1958. Chs. 14 & 16.

[3]"What the Cost of Education Means to Your Schools," *School Management*, Vol. 10, No. 1, January, 1966, p. 111.

characteristic of most general state aid formulas.

It was felt that the range of weightings used in this study (1.00 to 1.30) would show a "breakpoint," if one exists, with stronger cost-quality correlations resulting at the optimum weighting. State aid programs employ weighting on the assumption of added costs of secondary education programs. The measured expenditure per pupil will be lowered as the weighting is increased. At the mean of the districts in this sample, each five percent weighting reduces the computed expenditure level by approximately ten dollars per pupil. Thus, in effect, the weighting of secondary pupils reduces the expenditure level measure. Actual cost, which ought to be the measure of financial input if it is intended to obtain a true relation between cost and quality, is not the yardstick when weightings are used, but a measure that favors the high school, making it look less costly than it actually is.

In order to compare various methods of computing school system expenditure it is necessary to examine these expenditure measures in relation to some criterion. The most satisfactory criterion would be an independent measure of school quality. Such a measure is not at the moment available. A substitute criterion is a series of input measures, relating mostly to staff, that previous research has shown to be related to an independent measure of school quality. Such a set of measures, referred to here as the Quality Related Composite (QRC), was therefore designed, not as an independent criterion of quality, but as a cluster of quality related factors. The QRC is composed of staffing adequacy variables, measures of teacher quality and provisions for instructional materials. When grouped logically, therefore, the QRC is based on the number of professional personnel, the degree to which teachers are provided with instructional materials and the assistance provided from non-professional employees. It is assumed that any method of computing expenditure that statistically predicts QRC better than some other method would also predict an independent criterion of quality. At any rate, it is suggested that if the results of this procedure are indicative of a more precise expenditure yardstick than what has been commonly used, the same procedure be followed with an independent quality criterion when one is available.[4]

The components of the Quality Related Composite are as follows:

Amount spent for Library Books and Audio-Visual Supplies per Pupil in ADA
Number of Teachers per 1000 Pupils in ADA
Number of Librarians per 1000 Pupils in ADA
Number of Guidance Counselors per 1000 Pupils in ADA
Number of Clerks and Secretaries per 1000 Pupils in ADA
Number of Teachers with Master's Degrees per 1000 Pupils
Minimum Teacher Salary
Maximum Teacher Salary
Average Teacher Salary
Teacher Salary at 10th Step with Master's Degree

In addition to the rational or subjective basis for the QRC, there is considerable research evidence attesting to the relationship of the component parts of the Composite to school quality.[5]

Statistical Procedures

Two basic statistical procedures were followed: zero order correlations were obtained between each of the sixteen expenditure computations and the ten QRC factors, using the five weights for secondary pupils units; and, a multiple regression program was used to combine the ten QRC factors as if they were a single measure.[6] The

TABLE 1
SIXTEEN METHODS OF COMPUTING SCHOOL SYSTEM EXPENDITURE
Multiple Regression Correlations with the Quality Related Composite

Expenditure Variable (per 1000 Pupils in ADA)	Multiple Correlation
1. Total Expenditures	.8240
2. Total Expenditures less Debt Service	.8110
3. Total Expenditures less Capital Outlay	.8676
4. Total Expenditures less Transportation	.8246
5. Total Expenditures less Fringe Benefits	.8113
6. Total less Debt Service and Capital Outlay	.8605
7. Total less Debt Service and Transportation	.8103
8. Total less Debt Service and Fringe Benefits	.7933
9. Total less Capital Outlay and Transportation	.8695
10. Total less Capital Outlay and Fringe Benefits	.8636
11. Total less Transportation and Fringe Benefits	.8111
12. Total less Debt Service, Capital and Transportation	.8611
13. Total less Debt Service, Capital and Fringe Benefits	.8534
14. Total less Debt Service, Transportation and Fringe Benefits	.7913
15. Total less Capital, Transportation and Fringe Benefits	.8650
16. Total less Debt, Capital, Transportation and Fringe Benefits	.8530

[4] Eg., "Indicators of Quality", *IAR Research Bulletin*, Vol. 7, No. 3, May, 1967.
[5] Donald H. Ross, *op. cit.*
[6] COSTAR Statistical Routines, COREGN—Correlation and Regression Program, Columbia University Computer Center, June 11, 1965. (mimeographed)

TABLE 2
FIVE WEIGHTING METHODS FOR SECONDARY PUPIL UNITS
Multiple Regression Correlations with Quality Related Composite

Expenditure Variables	Secondary Pupil Weightings 1.00	1.15	1.20	1.25	1.30
1. Total Expenditure	.8240	.820	.817	.815	.813
2. Total Expenditure less Debt Service	.8110	.806	.804	.803	.800
3. Total Expenditure less Capital Outlay	.8676	.863	.861	.858	.856
4. Total Expenditure less Transportation	.8246	.820	.818	.816	.814
5. Total Expenditure less Fringe Benefits	.8113	.806	.804	.801	.798
6. Total Expenditure less Debt Service and Capital Outlay	.8605	.856	.854	.851	.849
7. Total Expenditure less Debt Service and Transportation	.8103	.806	.804	.802	.800
8. Total Expenditure less Debt Service and Fringe Benefits	.7933	.788	.786	.783	.780
9. Total Expenditure less Capital Outlay and Transportation	.8695	.865	.863	.861	.858
10. Total Expenditure less Capital Outlay and Fringe Benefits	.8636	.858	.856	.853	.850
11. Total Expenditure less Transportation and Fringe Benefits	.8111	.806	.804	.801	.799
12. Total Expenditure less Debt Service, Capital Outlay and Transportation	.8611	.857	.855	.852	.850
13. Total Expenditure less Debt Service, Capital Outlay and Fringe Benefits	.8534	.848	.845	.843	.840
14. Total Expenditure less Debt Service, Transportation and Fringe Benefits	.7913	.786	.784	.781	.779
15. Total Expenditure less Capital Outlay, Transportation and Fringe Benefits	.8650	.860	.857	.855	.852
16. Total Expenditure less Debt Service, Capital Outlay, Transportation and Fringe Benefits	.8530	.848	.845	.843	.840

program specified the selection of the "best" equation from a set of independent variables (the QRC factors) and the additional variables were added to the equation in order of their decreasing contribution to the multiple.

The results of this procedure are presented in Tables 1 and 2. Variables 6 and 12 are the ones commonly employed in cost-quality studies to represent a measure of expenditure. We see that their prediction of QRC is high, but they by no means represent the only high predictors of QRC, or even the highest. In fact the simple removal of capital outlay from total expenditure provides a better predictor. It would appear from a careful examination of all the variables that the presence of capital outlay in the cost computation lowers the relationship to QRC. On the other hand, the presence of debt service seems to improve the relationship. The best predictor (though not significantly better than Nos. 3, 6, 12 and 16) is No. 9, total expenditure less capital outlay and transportation.

Also contrary to common practice in computing expenditure in cost-quality studies, is the apparent fact that weighting secondary school pupils does not improve the predictability of the measure. Observing the correlations in Table 2, one can note that the Total Expenditure-QRC correlation drops from .824 to .813 as the weighting of secondary pupils changes from 1.00 to 1.30. The same effects appear in all the other fifteen multiple correlations exploring a "best" weighting for each combination of subtrahend. Methods of weighting derived from procedures for equalizing state aid, therefore, exert a negative influence on the cost-quality correlation. While it may seem logical to assume a greater cost differential for secondary education when devising school aid formulas, the results of this study indicate reason to seriously doubt the validity of the common practice of assigning arbitrary weightings to secondary school pupil units in computing a cost variable to be used in cost-quality studies.

Conclusion

This study casts some doubt on the validity ot the cost measures which have been used in most of the cost-quality studies, including those undertaken in the Institute of Administrative Research, where weighting for secondary school pupils has been the common practice. The criterion employed here is not an independent measure of quality and therefore these results must be viewed as tentative. It is suggested, however, that this study be replicated when an independent criterion, such as the *Indicators of Quality,* or the achievement test criterion being developed, becomes available.

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